ARCHITECTURAL OPPORTUNTIES FOR TREATED WOOD: CHALLENGE OF THE FUTURE

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Editor's Note: This presentation consisted primarily of color slides. Both the large number of slides and the need, in many cases, for color precluded the publication of most of the illustrations. Some of the text which follows may appear abbreviated without the accompanying illustrations.

WOOD AND ARCHITECTURAL EXPRESSION

Architectural expression is often influenced most heavily by the availability of building materials indigenous to a regional or more local area. In some places one finds an architecture founded on the abailability and use of masonry materials: brick, adobe, coursed and uncoursed rubble and so forth. The use of such materials also generates a tradition of craftsmanship related not only to the joinery involved but also the appropriateness of the detailing, which is most often a function of the physical property of the materials in conjunction with climatic conditions.

In our part of the world, the material and the architectural expression is wood. The designer uses wood for the structural frame, the exterior finish, the interior finish, the trim, the decor, and everywhere else he or she can rationalize its use--and even in many places where it can't be rationalized. The architect has had a continuing love affair with wood. It's warmth, workability and, in our part of the world, availability, offer the designer a wonderful palette for design expression.

Of course, we have no exclusive rights to the use of wood. It has been used for thousands of years, as attested to by the temples of Japan and China. The beauty of wooden structures effectively spans the centuries from ancient to modern. There are examples of wood being used in countless ways to enhance the appearance and utility of structures and in the hands of a gifted designer the results are wonderful indeed.

SOME EXPOSURES RESULT IN DECAY

Despite their beauty, there is a problem with some of these uses in that they expose wood to water which, in untreated wood, results in decay. Design details which collect and hold water are inherently dangerous in wooden structures, even if attempts are made to seal or protect them with some sort of "miracle goop" or finish. There really is no satisfactory, reliable substitute for the direct shedding of exterior water from a structure. Such details to be avoided include: sills at or below outside grade, structural slabs which extend beyond exterior walls, wood to wood joints (especially end grain) which are exposed to the weather, absorptive materials (such as carpet) on exterior deck surfaces, and trying to correct bad flashing details with "miracle goop."

ARCHITECTS WILL CONTINUE TO OVEREXTEND WOOD PERFORMANCE

The architect will continue to exploit and stretch the capabilities of the material. It seems inherent in the species. For example, the pole structure is a relatively recent innovation in wood architecture. It would not be possible without the development of pressure treating materials and techniques. But if one looks carefully at typical pole structures, one finds that the poles are treated but nothing else. The architect of today, particularly when designing pole structures, seems prone to insist that it "all hang out." As much of the structure as possible is exposed as an integral part of the architectural expression. But what about the safety of all those exposed beams, girders and other untreated members? There are significant hazards to this very bold architectural expression. But they only pose the problem--not the answer. Is this something that belongs in the lap of the wood industry, particularly the wood treaters, for solution, or is it the responsibility of the design and construction community to learn to stay within wood's existing capabilities for performance?

GREATER USE OF TREATED WOOD IS NEEDED

There are a number of factors which indicate a need for greater use of treated wood in structures. One such area is the use of exposed glu-lams; architects seem prone to continue wanting to do this. It's certainly understandable, because, from an aesthetic standpoint, some very beautiful and stunning things can be done for a structure this way, which are unique to the medium of wood. In a significant way, perhaps, continued reliance upon wood in major structures could rest on our ability to allow architects to do these sorts of things safely. This means that one goal for the future should be the development of procedures for effectively pressure-treating glu-lams, either by treating the laminants in such a way that gluing is not affected (the most promosing choice, in my opinion), or by getting deeper penetration of entire beams.

Evidence (1) suggests that much of the heartwood from the young-growth of our decay-resistant species may be of lower decay-resistance than the corresponding old-growth (Table 1). This means that, to preserve traditional markets and prevent unexpected product failures, young-growth lumber from these species may need to be routinely pressure-treated.

There is also a need (2) for greater quality control in the treating industry to improve confidence in relying on treated products in situations where it is perceived that effective treatment is essential (Table 2). Using treated-wood foundations in regions of high subterranean termite activity or exceptionally high decay hazard, and use of pole foundations in major projects are just two important areas of need in this regard, where the user must have absolute assurance that the wood will serve for the life of the structure or they will be unwilling to take the risk and will specify other materials.

THE DESIGN AND CONSTRUCTION COMMUNITY IS RESPONSIBLE

Most of the problems we have experienced with wood construction cannot be laid on anyone but the construction industry and the design professions. As we look at some of the really dramatic failures in wood structures, the failure of the designer to provide for such things as adequate ventilation for soffits and properly detailed flashing conditions, coupled with the obvious ineptness of the builder to properly assemble the pieces, make us realize that no matter what the wood industry comes up with in the advancement of technology, the menace of improper design and poor construction will probably remain with us.

Roofs, as we all know, are a primary source of protection against water infiltration. Yet the proliferation of failures in roof membranes of all types remains one of the most frequent generators of litigation against builders and malpractice suits against design professionals. We have an industry which has not yet, over the many years, mastered the built-up roofing membrane and we are already faced with a profusion of liquid elastomeric systems intented to provide a "fix" for this problem. To make matters still worse, we are now faced with the advent of the single ply sheet membrane. There have been over 400 single ply systems put on the market in the United States in the last few years.

A building cannot be perceived to be a mere assemblage of individual parts but, rather, must be conceived and constructed with knowledge of the interaction of the parts, one with the other. Each individual material may be fine and proper unto itself, but its incorrect use or installation may bring disaster to another component. Bad flashings, failed roof membranes, etc., all can conspire to permit water infiltration and create that perfect environment for the growth of wood decay and the destruction of a building.

Architects love to design in wood and develop new and innovative design solutions. Over the years, the wood industry has given them some new materials: glu-lams, pressure-treated stock, etc. The architect, as a designer, can be expected to use all of these, and sometimes will use them in adverse environments and in inappropriate ways.

EFFECTIVELY TREATED WOOD IS NEEDED

Many of the details and materials choices made by designers have proven not to work well with untreated wood. Either effectively treated wood will have to become available for these applications, or failures will continue to occur and, eventually, alternative materials will take the place of wood for these uses--in many cases, much less satisfactorily. Some of the critical areas where effective treatment is needed include: exterior decks, exposed beams and columns (especially in stairways), wooden stairway systems, bridges, exposed glu-lams, even glu-lams and timbers covered with stucco but protected by inadequate membranes, foundation pilings, panel siding, shakes and shingles, and playground equipment.

INNOVATIVE THINKING IS REQUIRED

It would be a dull world, in terms of the built environment, if we either had to stop the evolution of the design process where it now stands, or attempt to retreat to an even safer mode. We are not at the finite end of technical achievement in the use of wood or the development of wood products. From the very limited view afforded me as an architect (2nd author), I feel that if more than just the surface has been scratched, with regard to our potential for use of wood in structures, the probe certainly has not gone much below the surface. I would like to exhort you to greater efforts to do combat with the very real problems that have been presented here. And finally, those of you among the community of scientists and specialists in wood have knowledge of the behavioral characteristics of wood far beyond that of the construction industry and the design professions. We need your help. Can you find the time and make the effort to be involved in the problems of the performance of wood in structures and to share your knowledge and teach us so that we can do it better?

FUTURE CHALLENGES FOR THE TREATING INDUSTRY

There are a number of challenges which I believe the treating industry may have to meet in the future if it is going to fluorish, or perhaps even survive. These are my own (1st author) personal opinions, but since they have been generated by a considerable amount of thought and experience, I hope the industry will give them some thorough consideration before just rejecting them as trivial or impractical.

1. Develop the quality control necessary to assure 100% compliance when treating to FDN specifications.

2. Develop a treatment which will both preserve and dimensionally stabilize panel siding--both plywood and hardboard, if possible.

3. Develop effective methods for treating glu-lams for exterior exposure.

4. Add water-repellents to conventional preservative formulations, based on the excellent performance of water-repellents without preservatives in the above-ground tests reported by Feist (3).

5. Consider pressure-impregnation with water-repellents alone. With the loss of effective on-site treatments, we may be forced to change our thinking to accomodate above-ground treatments which are not simply lower concentrations of the chemicals used for ground-contact, but constitute a completely different set of materials which may perform well in above-ground exposure but could not perform adequately in ground contact.

6. Develop the use of CCA as a sole exterior finish, especially with added water-repellency, based upon the results of Feist (4), which demonstrated the UV-screening and dimensional-stabilizing properties of chromium in chromium trioxide.

7. Develop a preservative system for wooden playground equipment which would meet the "non-toxic" criteria of an increasing number of parent and community groups.

8. Develop a combined fungicide/fire retardant/water repellent treatment for wood shakes and shingles.

9. And finally, the most "far out" of the challenges, but the one with the greatest "breakthrough" potential, is to develop a through-penetrating treatment, probably based upon some sort of radiation or gas-phase system, for making the cell walls of wood hydrophobic, rendering it both immune to

decay without the use of residual chemicals and dimensionally stable, and thereby overcoming the two most disadvantageous properties of wood which complicate its use in structures.

REFERENCES

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3. Feist, W.C. 1984. Windows--Replacement wooden frames and sash: protecting woodwork against decay. U.S. Nat. Park Serv. Preservation Tech Notes No. 4, 3p.

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Table 1.

PERCENT OF REDWOOD TREES WITH BUTT OUTER HEARTWOOD IN VARIOUS DECAY RESISTANCE CATEGORIES*

Decay Fungus/ Resistance Category	Old Growth	Young Growth
<u>Poria placenta</u>		
very resistant	36 %	7 %
resistant	58	39
moderately resistant	6	54
slightly/nonresistant	0	0
<u>Gloeophyllum trabeum</u>		
very resistant	92	17
resistant	8	27
moderately resistant	0	43
slightly/nonresistant	0	13

* Clark, J.W. and T.C. Scheffer. 1983. F.P.J. 33(5):15-20.

Table 2.

CONFORMANCE OF SAMPLES TO AWPA-C2 PENETRATION REQUIREMENTS*
(percent of total)

Sample Group/ Preservative	Initial Survey	Resurvey
<u>All species</u>		
CCA	10 %	37 %
ACA	75	50
<u>Douglas-fir only</u>		
CCA	6	0
ACA	71	50
<u>By planermill M.C.- all species</u>		
<u>SGRN</u>		
CCA	2	23
ACA	60	50
<u>SDRY</u>		
CCA	23	43
ACA	-	-

*Dost, W.A. 1982. AWPA Proc. 78: 155-62.